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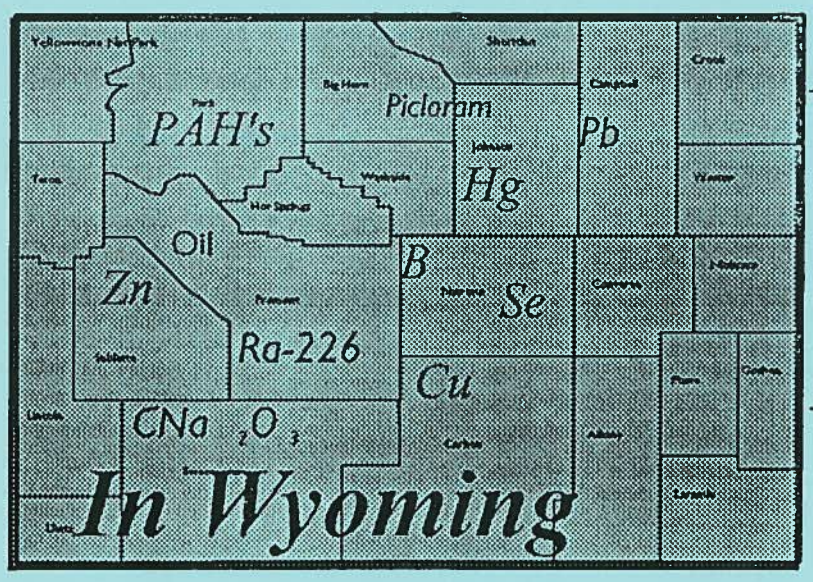
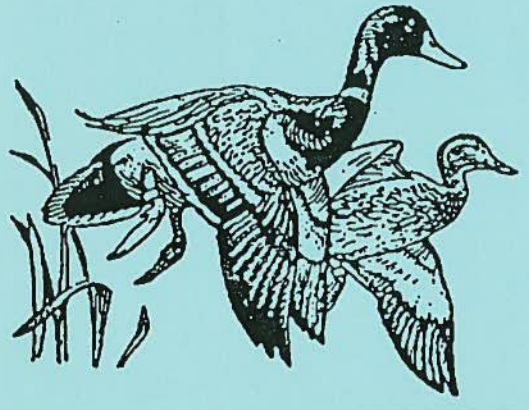
U.S. FISH & WILDLIFE SERVICE
REGION 6
CONTAMINANTS PROGRAM

Environmental Contaminants Issues In Wyoming





U.S. Fish & Wildlife Service
Ecological Services
2617 East Lincolnway - A
Cheyenne, Wyoming 82001
October 1993

RPT 202

Environmental Contaminants Issues in Wyoming

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Project # 91-6-6259

U.S. Fish & Wildlife Service
Ecological Services
Wyoming State Office
2617 East Lincolnway-A
Cheyenne, Wyoming
82001

October 1993

Summary

The environmental contaminants program at the U.S. Fish and Wildlife Service Ecological Services Office in Cheyenne, Wyoming was initiated in May 1988. The goal of the environmental contaminants program is to **protect** and **improve** the quality of fish and wildlife resources by:

* **identifying environmental contaminants problems affecting fish and wildlife resources;**

* **preventing environmental contaminants from adversely affecting fish and wildlife resources;**

* **correcting environmental contaminant problems; and**

* **assisting in the restoration of fish and wildlife habitats adversely impacted by environmental contaminants.**

This assessment of environmental contaminants issues in the state was conducted to facilitate long-term planning of the program. Information presented in this report is also intended to provide a concise overview of contaminants issues to U.S. Fish and Wildlife Service (FWS) managers at the Regional and Washington offices. Major activities that pose or may pose contaminant risks to fish and wildlife resources in Wyoming include:

* **mining**
* **hazardous materials sites**
* **oilfield waste pits**
* **Superfund sites**
* **illegal pesticide use**
* **irrigation return-flows**
* **oilfield produced waters**
* **evaporation ponds**

The strategy for protecting and improving the quality of fish and wildlife resources in Wyoming involves continued public outreach to increase awareness of environmental contaminants; increase coordination with EPA and the Wyoming Dept. of Environmental Quality on assessment of Resource Conservation and Recovery Act (RCRA) and Superfund sites; work with the private sector in a cooperative manner to resolve contaminants problems; provide technical assistance to the FWS's Law Enforcement agents in their efforts to enforce the Migratory Bird Treaty Act.

Updates are planned for this document as additional information becomes available and other contaminant issues are identified. Thanks are extended to Kim Dickerson, Alan Copeland and Joni Armstrong for their contribution to this report. Thanks are also extended to Thomas C. Maurer and George T. Allen of the U.S. Fish and Wildlife Service and Tom Collins from the Wyoming Game and Fish Department for reviewing this publication and providing helpful suggestions.

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Bentonite Mining

Wyoming is the nation's number one bentonite-producing state. Bentonite mining primarily causes surface land disturbance. Bentonite is a clay composed mostly of the mineral montmorillonite. It is usually found interbedded with Cretaceous marine shales.

Bentonite is used in oil well drilling mud, and as a sealant and binder in many manufacturing processes.

Bentonite is mined around the margins of the Black Hills uplift and in the Bighorn Basin in Big Horn, Converse, Crook, Johnson, Hot Springs, Natrona, Park, Platte, and Washakie counties.

Suspected Contaminants:

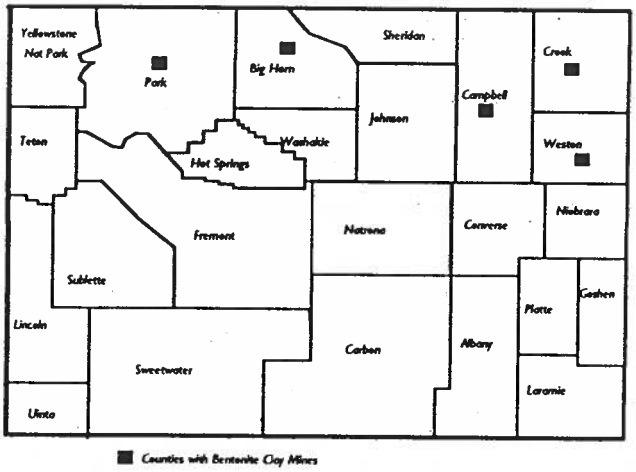
Trace Elements, Total Solids, Salts

Suspected Problem:

Bentonite mines may degrade stream habitat and water quality. Wetland creation in inactive or abandoned bentonite pits may pose a risk to trust resources. Wildlife can become entrapped in the soft clays.

Creteaceous marine shales are potentially seleniferous. Selenium mobilization and bioaccumulation may be occurring.

Wyoming



Action Taken:

The Wyoming Department of Environmental Quality (DEQ) Abandoned Mine Lands Program has reclaimed inactive or abandoned bentonite mines. Sites where wetlands have formed in open pits are usually backfilled and covered if the bottom substrate is a clay bog that can trap terrestrial wildlife. If a wetland is backfilled, new ponds are excavated. In some cases, wetlands may not be filled, or only shorelines will be modified if they provide aquatic habitat and represent no risk of entrapment to terrestrial wildlife.

Recommended Action:

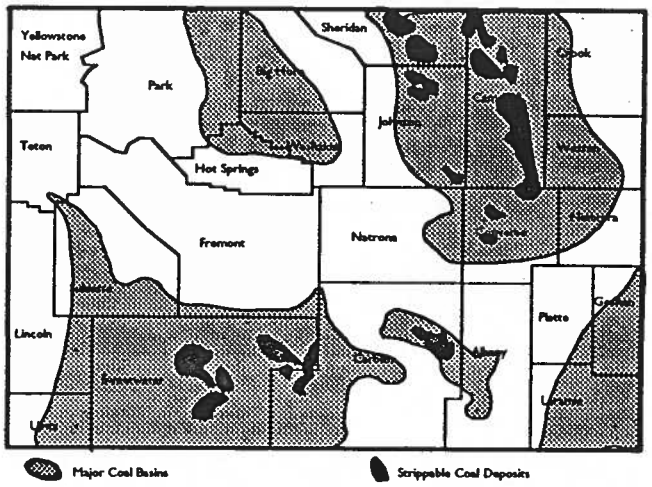
Site assessments of potential contaminant risks should be conducted at bentonite mines. Samples from water and/or soils should be collected and submitted for contaminant analyses. Agencies involved in the creation of wetlands from inactive or abandoned bentonite mines should be made aware of potential water quality problems stemming from Cretaceous marine shales. Wetlands developed over Cretaceous shales should be surveyed for trace element bioaccumulation.

Coal Mining

Wyoming is the largest coal-producing state in the United States. Today, 99 percent of the coal mined in Wyoming is produced by surface-mining methods. Surface mines in the Powder River Basin produce at least 90 percent of Wyoming's coal.

Bituminous coal, from which coal tar pitch is derived, contains a number of aromatic and aliphatic hydrocarbons and a variety of toxic trace elements such as antimony, arsenic, beryllium, cadmium, lead, nickel, chromium, cobalt, titanium, and vanadium. In Wyoming, the major elements which make up more than 0.1 percent of a coal are silicon, calcium, aluminum, iron, and magnesium, usually in that order of abundance.

Wyoming



Suspected Contaminants:

Trace Elements
Oil and Grease
Suspended Solids
Acid drainage (high-sulfur coals)
Alkaline drainage (low-sulfur coals)

Suspected Problem:

Coal mines and associated waste disposal sites can contaminate soil, surface water and groundwater.

Resource Problems Identified:

Experimental underground coal-gasification burns have contaminated ground water in Campbell, Carbon and Converse counties with suspected carcinogens and constituents included on the EPA's priority list. Large concentrations of dissolved-solids in ground water have been associated with spoil material at coal mines in Wyoming. Surface coal mining at several sites in the Powder River basin have resulted in large concentrations of selenium in ground water after mining.

Action Taken:

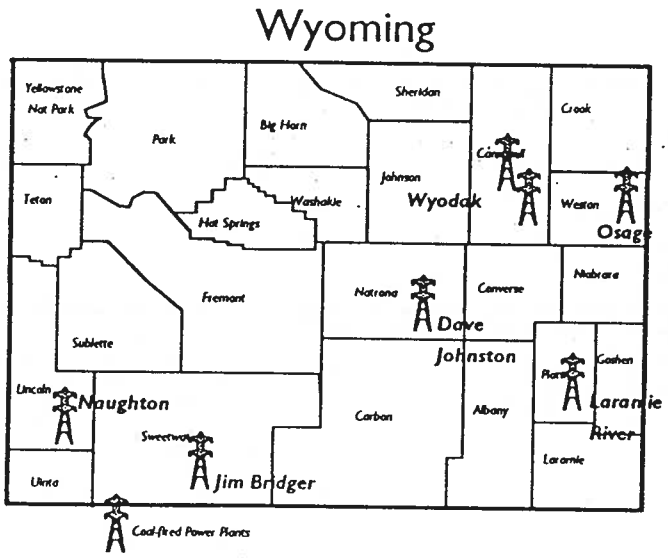
Wyoming DEQ permits wastewater discharges from coal mines through the NPDES program. FWS reviews NPDES permits. Wyoming Game and Fish Department reviews mine reclamation projects.

Recommended Action:

Studies of coal mine discharges to surface waters or storage ponds and effects to aquatic birds should be initiated. Current or proposed wetland reclamation sites should be evaluated for contaminant risks to trust resources. Water quality data and fish and wildlife use should be documented at future coal mines and evaluated after mining activity has begun.

Coal-fired Power Plants

Coal-fired electric generating plants operate in Campbell, Converse, Lincoln, Platte, Sweetwater and Weston counties. Coal conversion or combustion processes release complex aromatic and heterocyclic compounds, many which can be hazardous to fish and wildlife. Trace elements that are naturally abundant in coal and inorganic compounds used as catalysts are capable of posing a biological threat.



Suspected Contaminants:

Trace Elements	Carbon Monoxide	Sulfates
Nitrates	Radionucleides	PAH's
Organics	Ozone	
Volatile Organic Compounds		Acid Rain
Volatile Trace Elements		
Sulfate Aerosols		
Peroxyacetyl Nitrate (PAN)		

Suspected Problem:

Coal-fired power plants emit contaminants to the atmosphere, surface waters, groundwater, and soils. Acid deposition from fossil-fueled power plants can have adverse effects to biota in both aquatic and terrestrial ecosystems. Yellowstone National Park and Wyoming's Wind River Range are threatened by acid precipitation. Disposal of fly ash and scrubber sludge can cause impacts to aquatic systems from direct discharges, and seepage and overflow from waste-disposal basins.

Known Contaminants:

Sodium in Scrubber Wastewater

Resource Problems Identified:

Bird mortalities due to sodium toxicity and salt crystallization have occurred in evaporation ponds at the Jim Bridger and Naughton Power Plants.

Action Taken:

In 1991, the FWS collected water samples from a pond at Jim Bridger Power Plant. The water was analyzed for trace elements. In 1992, FWS informed the Naughton and Jim Bridger Power Plants of the need to prevent bird deaths in the power plant wastewater ponds.

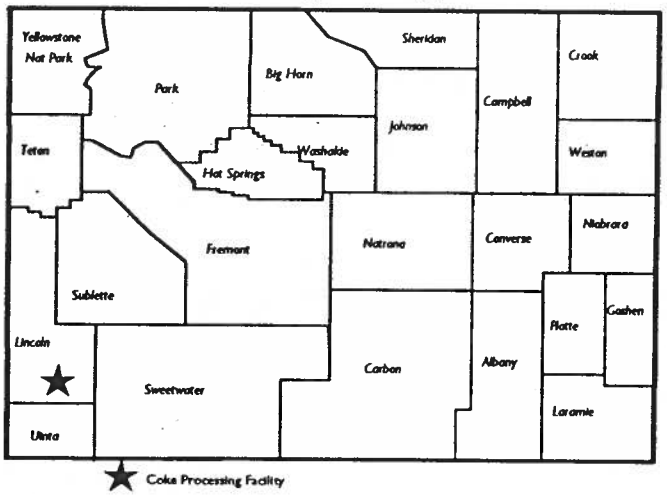
Recommended Action:

FWS should inform power plants to eliminate or cover ponds to prevent bird deaths. FWS, National Ecology Research Center's study of acid-sensitive wetlands in Wyoming should be reviewed. Further studies of acidified wetlands should be considered.

Coke Processing

Bituminous coal, from which coal tar pitch is derived, contains a number of PAHs, and a variety of toxic trace elements such as antimony, arsenic, beryllium, cadmium, lead, nickel, chromium, cobalt, titanium, and vanadium. A coke plant operates near Kemmerer in Lincoln County. Coke is produced by heating coal in ovens to remove moisture. After the heating process, gases generated during the coking process are cooled by heat exchangers or cooling towers. Wastewater from the cooling process can contain ammonia and PAH's.

Wyoming



Suspected Contaminants:

PAHs	Other Organics
Carbazole	Volatile Organics
Phenanthrene	Anthracene
Acridine	Pyrene
Benzo(a)pyrene	

Suspected Problem:

Solid waste disposal can cause impacts to aquatic systems from direct discharges, seepage and overflow from waste-disposal basins. Major impacts are usually associated with contamination of water resources by trace elements. Wet storage (ponding) of coal ash and sludge wastes may attract and adversely affect birds. Coal tar pitch manufacturing and use in products exposed to the environment may adversely affect fish and wildlife.

Resource Problems Identified:

Bird mortality has occurred on a waste pond at the Coke Plant near Kemmerer. In 1976,FWS and Wyoming Game & Fish Dept. personnel collected over 200 birds during a four year period. Most birds that landed on the pond died.

Action Taken:

In 1976, the U.S. Attorney, a Wyoming Game and Fish Biologist, and FWS Law Enforcement Agent contacted the FMC Coke Plant concerning bird deaths at their pond. Coke plant guards used shot guns, cracker shells, and Zon exploders to scare off birds. The plant quit dumping tar into the pond and built a smaller pond to contain waste. The plant also planned to reduce the amount of contaminated water discharged into the pond.

Recommended Action:

FWS should inform coke processing companies of their liability under the Migratory Bird Treaty Act and the need to eliminate or cover waste ponds to prevent bird deaths. FWS should consult with companies to set reasonable time frames for developing alternatives and implementing measures to eliminate bird mortalities at their waste ponds.

Animal Damage Control Programs

Several pesticides that are extremely toxic to birds and mammals have been illegally used for predator control. Carcasses are laced with pesticides or other poisonous compounds and left on the rangeland to kill predators such as coyotes. Eagles, other raptors and scavenging birds feeding on the carcasses are usually killed by the toxins.

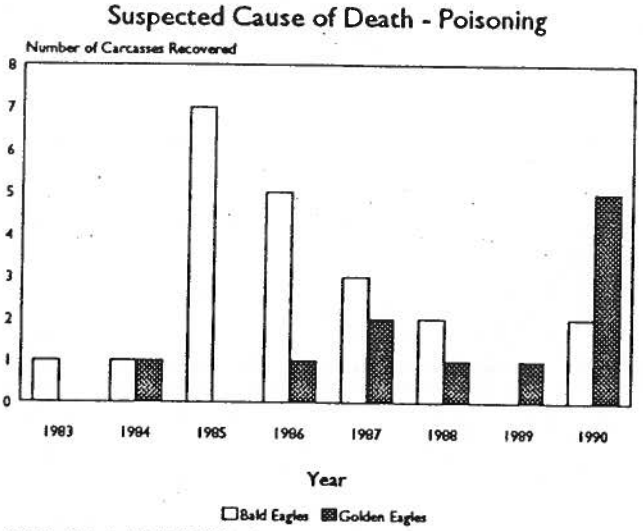
Known Contaminants:

Thallium Sulfate (1080)
Aldicarb
Strychnine
Fenthion
Famphur

Resource Problems Identified:

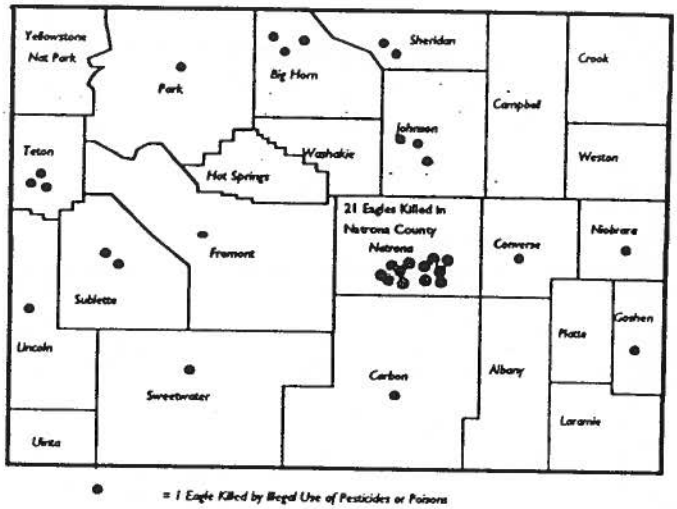
Ongoing U.S. Fish and Wildlife Service Law Enforcement investigations have documented numerous eagle poisonings throughout the state.

Eagle Carcasses Recovered



NOTE - 21 Eagles Killed in 1971 Not shown.

Wyoming



Action Taken:

Law Enforcement investigations are ongoing. Prosecutions pending as of 1992. FWS Environmental Contaminants personnel have assisted Special Agents with investigations and in submitting eagle carcasses to laboratories for analyses.

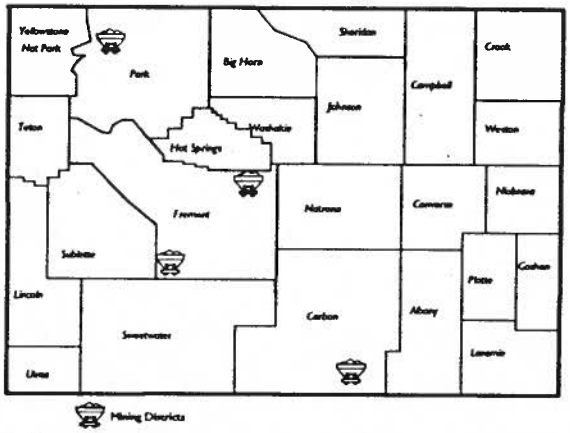
Recommended Action:

Investigations by Law Enforcement should be continued. EC Program should continue to assist by submitting eagle carcasses to laboratories for chemical analyses to determine which pesticides are illegally used to poison eagles. The U.S. Fish and Wildlife Service should recommend stricter controls, or if necessary; recommend bans of pesticides used to kill eagles. The Service should pursue an aggressive public awareness program. Volunteer help from raptor rehabilitation groups in the state should be solicited for public education. Grants should be provided to volunteers to cover travel and other expenses. Raptor education booths should be set up at state fairs and rodeos. The Service should work with the media to promote raptor conservation.

Hard Rock Mining

Copper and gold are the only metallic minerals mined in Wyoming since the 1800's. Limited copper mining activity occurs at the Ferris-Haggerty mine in the Sierra Madre Mountains in Carbon County. Mining and processing operations have created copper mine tailings at the Ferris-Haggerty mine. Gold mining is limited primarily to recreational suction dredging in streams; however, small-scale placer operations occur in the South Pass area in Fremont County. Both cyanide heap leach and underground methods were used in the South Pass district. Gold mining permits have been issued for operations in Albany, Crook, Fremont, Park, Shoshone, Sweetwater, and Teton counties. Gold exploration occurred in the 1980's at Pacific and Cottonwood Creeks in Teton County. Proposed gold mining near Cooke City, Montana could impact Soda Butte Creek and Fisher Creek. Soda Butte Creek flows into Yellowstone National Park. Fisher Creek flows into the Clark's Fork of the Yellowstone drainage.

Wyoming



Suspected Contaminants:

Trace Elements Radium 226
Uranium
Oil & Grease

Suspected Problem:

Surface run-off from copper tailings at inactive mine sites can contaminate nearby surface water.

Known Contaminants:

Copper Mercury

Resource Problems Identified:

Mine portal water from the Ferris-Haggerty mine in the Sierra Madre mountains exceeds NPDES criterion for copper and has contaminated Haggerty Creek which is biologically dead for at least 1 mile downstream from the mine. Soil contamination occurs at other historic, abandoned copper mines such as Kirwin near the Wood River. Wyoming DEQ; however, has not found contamination in the river. Past gold mining practices have decreased bank stability, increased sedimentation, and may have contributed to increased mercury concentrations in Rock and Willow Creeks near Atlantic City.

Action Taken:

DEQ is reviewing enforcement options, and pursuing legal action and clean-up at the Ferris-Haggerty mine. The Wyoming Game and Fish Department has conducted bioassays and analyzed fish collected from Rock Creek for mercury contamination.

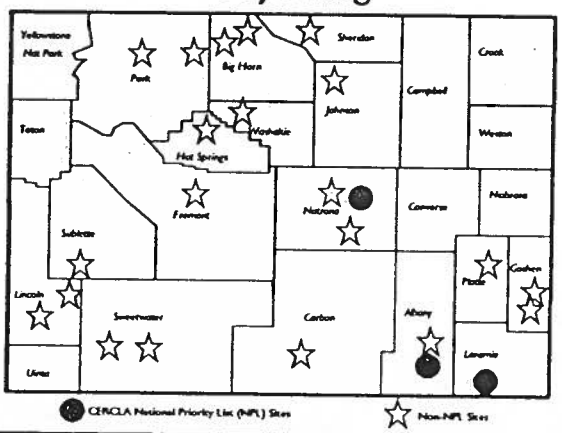
Recommended Action:

FWS should support and encourage clean-up of the Ferris-Haggerty mine site and rehabilitation of Haggerty Creek to eliminate risk and/or injury to trust resources. Possible injuries to trust resources should be assessed from present and past hard-rock mining activities. FWS should review future gold mining permits and provide resource protection recommendations..

Hazardous Materials Sites

Hazardous material sites include landfills; Resource Conservation and Recovery Act (RCRA) sites (facilities that generate, transport, treat, store, incinerate, and/or dispose of hazardous materials); and Superfund sites identified by the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Cities, counties, and solid waste disposal districts (SWDD) operate municipal landfills. Construction, petroleum, trona, coke plant, power plants, and energy companies operate industrial landfills. A variety of facility types generate and/or handle hazardous wastes. The most common hazardous waste facilities are petroleum related; disposal facilities are the most frequent violators of proper procedures for handling of hazardous waste. There are 41 industrial landfills and 77 municipal landfills, 383 RCRA sites, and 128 CERCLA sites in Wyoming (Tables 1 and 2, Appendix).

Wyoming



Suspected Contaminants:

Pesticides Oil PAH's PCB's Acids Trace Elements Asbestos Organic Compounds

Suspected Problem:

Groundwater contamination is suspected at Rawlins, Cheyenne, and Casper landfills.

Known Contaminants:

Pesticides Herbicides Oil PCB's Diesel Fuel Gasoline Mercury Sodium Cyanide Arsenic Lead Acids Asbestos Solvents PAH's Metals Pentachlorophenol Radioactive Lead Volatile Organic Compounds

Resource Problems Identified:

Hazardous materials at most RCRA sites threaten ground water and soil. Contaminants threaten surface water at the Frontier Oil Refinery, Cheyenne and the Newcastle Refinery, Newcastle. There are three National Priority List (NPL) CERCLA sites in Wyoming: Baxter/UP Tie Treating facility at Laramie, Mystery Bridge site at Evansville, and F. E. Warren Air Force Base in Cheyenne. Non-NPL CERCLA sites threaten ground water, surface water, soil and air.

Action Taken:

DEQ monitors groundwater wells at landfills and has reclaimed landfills near surface water. EPA has investigated contamination at CERCLA and RCRA sites in violation of federal permits and is pursuing corrective action. FWS prepared Preliminary Natural Resource Surveys for Mystery Bridge at Casper and Baxter/Union Pacific Tie Treating site at Laramie. FWS provided comments to EPA on the Mountaineer Refinery Site at La Barge.

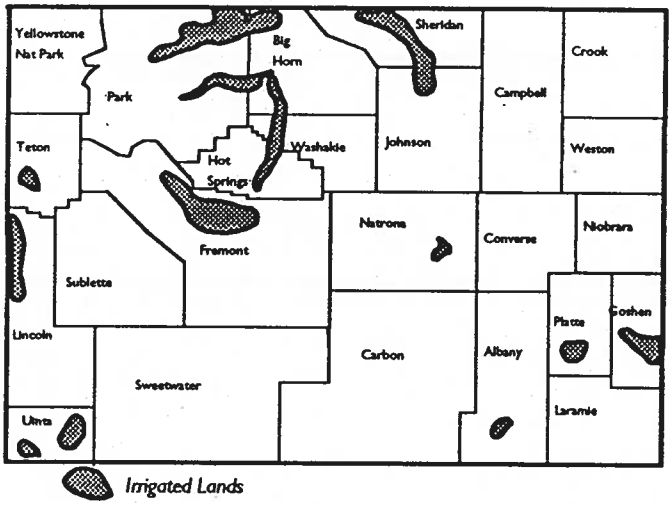
Recommended Action:

FWS should coordinate with EPA to obtain transfer funds to assess RCRA and CERCLA sites for risks to trust resources. Damage assessments should be conducted if necessary.

Irrigation Return-flow

Farming is a significant factor in Wyoming's social and economic health. Crops include: wheat, barley, oats, dry beans, sugar beets, corn and hay. Because Wyoming is semi-arid, use of irrigation water is extensive. Irrigation constitues 80 % of all water use in Wyoming. Approximately 75 % of farms and ranches use irrigation for crops or hay. Flood irrigation is used on 1.3 million acres and sprinkler irrigation is used on 200 thousand acres. Pesticide use varies with the type of crop grown.

Wyoming



Suspected Contaminants:

Selenium, Boron, Pesticides

Suspected Problem:

Wyoming has several geological formations that contain Cretaceous shale. Irrigation return flows often carry pesticide and fertilizer residues which leach selenium from the Cretaceous shale formations. Return flows may enter closed basins where evaporation concentrates the selenium. Although selenium is a necessary trace element, it can bioaccumulate in the food chain and lead to impaired reproduction or deformiities in aquatic birds.

Known Contaminants:

Selenium, Boron

Resource Problems Identified:

Impaired reproduction and deformities in aquatic birds at the Kendrick Reclamation Project are attributed to selenium. Elevated selenium concentrations were documented by the FWS in aquatic invertebrates at the Shoshone Irrigation Project.

Action Taken:

The FWS, U.S. Geological Survey and U.S. Bureau of Reclamation have completed reconnaissance and detailed investigations at the Kendrick Reclamation Project, Natrona County, and a reconnaissance investigation at the Riverton Irrigation Project, Fremont County. The USFWS has also conducted a baseline survey of trace elements at the Shoshone Irrigation Project, Park County.

Recommended Action:

Oxbows and closed basins receiving return flows and that provide aquatic bird habitat should be studied more closely. Irrigation districts needing more detailed study include: Owl Creek at Hot Springs County; Elk-Lovell at Big Horn County; Horse Creek at Goshen County; Cody Canal at Park County; and Westside at Big Horn County.

NPDES Permits

The Wyoming Department of Environmental Quality (DEQ) administers the National Pollutant Discharge Elimination System (NPDES) permit program. The NPDES program was established by Congress through the Clean Water Act. The Clean Water Act prohibits wastewater discharges to the Nation's waters except as allowed by an NPDES permit. NPDES permits pose restrictions on pollutants in the discharge. NPDES permits are grouped into 10 categories which include: municpal, commercial, industrial, oilfield produced waters, coal, coal bed methane, feedlot, state government facility, federal government facility, and fish hatchery.

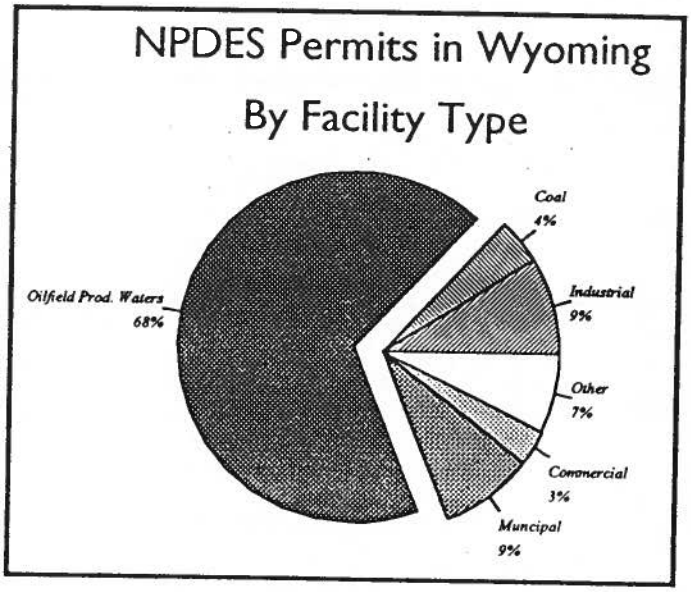
Surface waters in Wyomng are classified by the Wyoming DEQ into the following categories: Class 1 waters are surface waters in which no further degradation by point source discharges other than dams are allowed; Class 2 waters support or have the potential to support game fish; Class 3 waters support nongame fish only; and Class 4 waters do not support any fish.

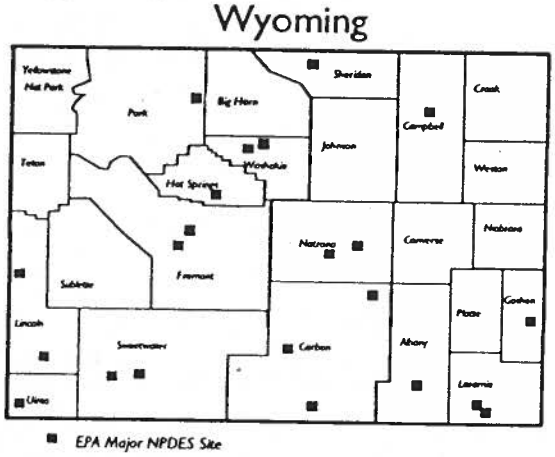
Suspected Contaminants:

Trace elements Organic Compounds
Pesticides Oil PAH's

Suspected Problem:

Non-compliance with NPDES Permit requirements by some wastewater dischargers may be a problem. Discharges of pollutants into waterways may result in chronic effects to aquatic organisms with resultant adverse impacts to the food chain and trust resources.





Action Taken:

The FWS Ecological Services Office in Cheyenne reviews NPDES permits and provides comments to Wyoming DEQ when necessary. The FWS is also field testing sediment pore water bioassay techniques for their utility in monitoring NPDES discharges.

Recommended Action:

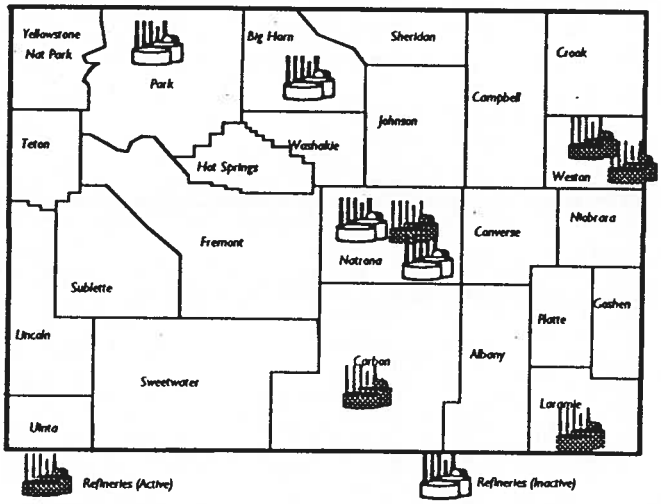
Biomonitoring of ecological communities downstream of major NPDES discharges should be conducted by the FWS. The FWS should integrate NPDES permit information into GIS to better assess the impacts of NPDES permit violations and cumulative impacts of wastewater discharges.

Oil & Gas Processing Facilities

Wyoming has consistently ranked in the top ten states for oil production. During the peak "oil boom" in the late 1970's and early 1980's, Wyoming had 13 refineries located at Cody (1), Newcastle (2), La Barge (2), Sinclair (1), Cheyenne (1), Casper (3), Glenrock (1), Lusk (1) and Franne (1). Currently, only the following refineries are in operation: Frontier at Cheyenne, Little America at Casper, Osage at Newcastle and Sinclair near Rawlins.

Natural gas processing plants extract butane, gasoline, propane and hydrogen sulfide. Hydrogen sulfide is reduced to pure sulfur. Large natural gas processing plants are located at Bairoil, Whitney Canyon, Carter Creek, Casper, Opal, Sinclair and Douglas.

Wyoming



Suspected Contaminants:

Trace Elements PAH's Oil
Hydrogen Sulfide

Suspected Problem:

Oil and other hazardous material spills can occur at refinery sites and gas processing plants and cause groundwater and surface water contamination. Wastewater evaporation ponds at refineries may pose a threat to migratory aquatic birds.

Known Contaminants:

Benzene Toluene Xylene

Resource Problems Identified:

Groundwater contamination has been identified near the Little America Refinery at Casper, as well as beneath refineries in Cheyenne, Cody, Evansville, Glenrock, Newcastle and Sinclair.

Action Taken:

EPA is addressing the groundwater contamination problem associated with the Little America Refinery at Casper under RCRA. The FWS conducted aerial bird surveys over wastewater ponds at refineries in Casper and Cody.

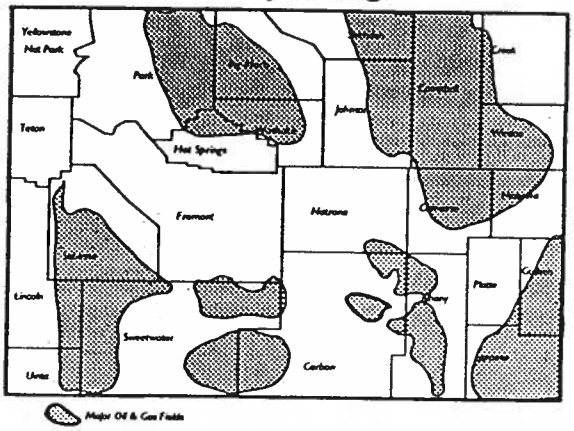
Recommended Action:

Continue aerial bird surveys to determine if birds are using wastewater ponds. Conduct Natural Resource Damage Assessments where appropriate. A damage assessment should be conducted on the North Platte River at Casper adjacent to the refineries to determine if groundwater contamination plumes are contributing contaminants into the river and the fisheries.

Oilfield Produced Water

Oil exploration and production is a major industry and source of revenue in Wyoming. In 1989, 109 million barrels of oil were produced from 11,397 wells. Approximately 1.6 billion barrels of produced water are generated annually in Wyoming. Oilfield produced waters occur in the oil reservoir and are drawn up along with oil or they are produced through the use of steam for enhanced oil recovery. Approximately 30% of oilfield produced waters are discharged to surface waters. Approximately 600 oilfield produced water discharges are permitted through the Wyoming DEQ's NPDES permit program. NPDES permits are issued for 5 years. Annual toxicity testing (bioassay) is required in discharges to all class waters except Class 4. Discharges are analyzed by the permittee for oil and grease once every 2 months. Oil and grease should not exceed 10 mg/l.

Wyoming



Suspected Contaminants:

Trace Elements Oil PAH's Radium-226
Salts
Total dissolved solids

Suspected Problem:

Hydrocarbons and trace elements in oilfield produced waters can adversely affect fish in the receiving waters. The chronic effects of oilfield produced waters to aquatic birds is not well documented. Hydrocarbons and trace elements could impair reproduction in migratory aquatic birds using wetlands created by oilfield produced waters.

Known Contaminants:

Trace Elements Oil PAH's
Radium Total dissolved solids

Resource Problems Identified:

Visible sheens have been noted at several oilfield produced water discharges. Visible sheens are prohibited by the Wyoming DEQ NPDES permits.

Action Taken:

Research on the effects of oilfield-produced waters on fish and aquatic invertebrates has been conducted by the FWS Research Station at Jackson, WY and by the University of Wyoming. FWS in Cheyenne is studying the effects of oil-produced waters on migratory aquatic birds at Loch Katrine, Park County, WY. The Colorado School of Mines has studied the used of created wetlands to treat produced water discharges.

FWS has informed dischargers of the possible impacts to migratory birds and the need to comply with NPDES permit criteria.

Recommended Action:

Studies on effects of oilfield produced waters on migratory birds should be continued. A symposium should be conducted to address past and current research on the environmental effects of oilfield-produced waters.

Pesticide Use

Pesticides (herbicides, insecticides and fungicides) are applied to agricultural crops, range and pasture, and livestock. The primary crops grown in Wyoming and receiving pesticide applications include: alfalfa, barley, dry beans, corn, oats, sugarbeets and wheat. Sugarbeets received the most intensive application of insecticides in 1990 (100% of the acreage grown). Dry beans received the most intensive application of herbicides in 1990 (100% of the acreage grown) and wheat received the most intensive application of fungicides in 1990 (39% of the acreage grown).

Pesticides such as carbofuran, aldicarb and famphur are extremely toxic to wildlife. Aldicarb and carbofuran are applied primarily on sugarbeets. Famphur is applied on cattle to prevent infestations of warble flies. The major crop producing areas and accompanying pesticide use are in Park and Big Horn counties along the Shoshone, Greybull and Bighorn rivers and in Platte and Goshen counties along the North Platte River.

Herbicides are also applied for noxious weed control and sagebrush eradication.Designated noxious weeds include pepperweed (*Lepidium latifolium*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), hoary cress (*Cardaria draba*), leafy spurge (*Euphorbia esula*), Russian knapweed (*Centoures repens*) and plumeless thistle (*Carduus acanthoides*). In 1991, herbicides were applied on 277,142 acres of rangeland.

Suspected Contaminants:

Picloram Tordon Chlopyrifos Malathion Fenthion Aldicarb

Suspected Problem:

Improper application of pesticides may be causing bird mortalities.

Known Contaminants:

Picloram

Resource Problems Identified:

Groundwater contamination has occurred in areas treated with herbicides such as Picloram.

Commonly Used Pesticides in Wyoming

Pesticide	Crops
Carbofuran	Alfalfa, Sugar Beets
Dicamba	Barley, Corn
2,4-D	Barley, Corn, Oats, Wheat
Ethalfluralin	Dry Beans
EPTC	Dry Beans
Trifluralin	Dry Beans
Terbufos	Corn
Cyanazine	Corn
Atrazine	Corn
Ethofumesate	Sugar Beets
Aldicarb	Sugar Beets
Metasulfuron	Wheat
Picloram	Rangeland
Famphur	Livestock

Action Taken:

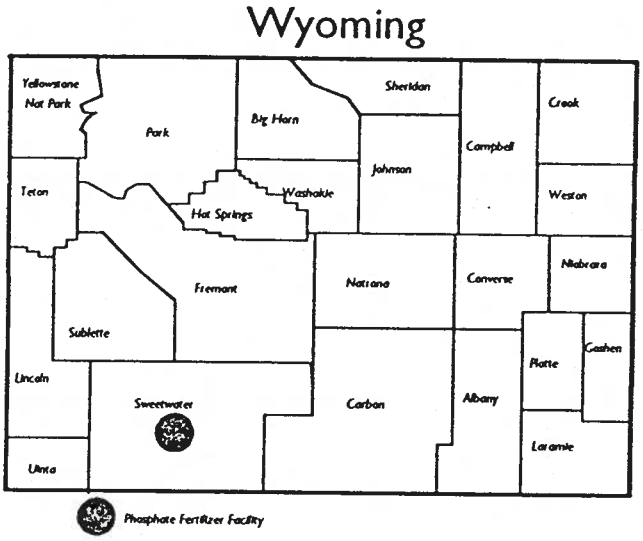
The FWS has provided a presentation on the Effects of Pesticides on Migratory Birds at the annual Pesticide Applicators Certification Workshop sponsored by the University of Wyoming Cooperative Extension Service. The FWS has also provided technical assistance to the Wyoming Dept. of Agriculture on pesticide application issues.

Recommended Action:

The FWS should work with the Univ. of Wyoming Extension Service and the WY Dept. of Agriculture to develop an educational videotape on the safe use of pesticides. FWS EC staff should continue to participate in the Pesticide Applicators Certification workshops. A network should be established to obtain reports of bird die-offs due to pesticides.

Phosphate Mining

A phosphate fertilizer plant operates near Rock Springs. Phosphate strip mining occurred at Leefe, west of Kemmerer in Lincoln county. Phosphate is treated with sulfuric acid and transformed into phosphoric acid and superphosphates for fertilizer. Gypsum and other impurities from the phosphate rock are stored in a 500-600 acre, synthetically-lined, tailings pond near the fertilizer plant.



Suspected Contaminants:

Phosphorous
Phosphate & Phosphate compounds
Phosphoric Acid
Sulfuric Acid
Trace Elements
Total Solids

Suspected Problem:

Discharges of chemicals from the fertilizer plant near Rock Springs could impact fish and wildlife directly through toxicity or bioaccumulation. Discharges of phosphorous may indirectly affect the receiving wetland through eutrophication.

Known Contaminants:

Acid

Resource Problems Identified:

Bird mortality has been observed in a wastewater pond at the fertilizer plant near Rock Springs. The wastewater pond has a pH of about 2 (personal communication, James Klett, 1992).

Action Taken:

The Wyoming Game and Fish Department conducted a study on bird deaths at Chevron's tailings pond in 1986.

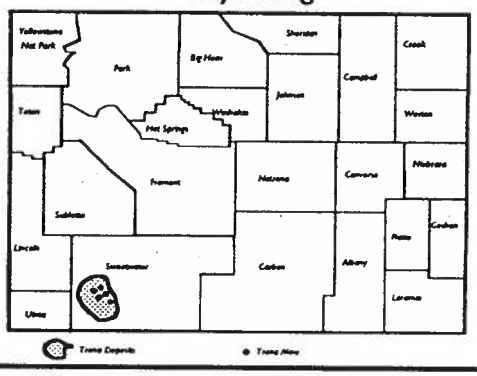
Recommended Action:

FWS should recommend that Chevron eliminate or cover their tailings pond to prevent bird deaths. FWS should consult with Chevron to implement measures to eliminate bird mortalities at their waste pond. FWS should determine whether a damage assessment is warranted.

Trona Mining

The Green River Basin hosts the world's largest trona deposit, estimated at well over 100 billion tons. This area has the only large-scale underground trona mines in the world. A trona mine operated by Rhone-Poulenc is located near the Seedskadee National Wildlife Refuge. Trona is a mineral composed of hydrous sodium carbonate and sodium bicarbonate; a mixture of washing soda and baking soda. Its technical name is sodium sesquicarbonate. Most of the trona mined in Wyoming is processed into soda ash. Residual, insoluble material is piped to the surface of tailing ponds and allowed to settle. The wastewater is highly alkaline (pH = 10.5) and consists primarily of sodium decahydrate. The decahydrate precipitates forming large crystals on objects in the ponds. Soda ash is used in the manufacture of glass, as the primary component in baking soda, in paper, fertilizer and detergent manufacturing, petroleum refining, and waste treatment.

Wyoming



Suspected Contaminants:

Trace Elements

Suspected Problem:

Large concentrations of dissolved solids in trona ponds can cause osmotic stress to organisms, and birds may die of sodium toxicity.

Known Contaminants:

Dissolved Solids Sodium
Sodium Decahydrate

Resource Problems Identified:

Substantial die-offs of migratory birds at trona ponds in Wyoming have occurred since 1972. From 1974 to 1981, trona companies reported a combined annual fatality rate of 13.3 percent of all birds (4,531) recovered from the ponds. Many more birds may die after release because the rehabilitation techniques may not reverse the effects of the decahydrate. Also, more birds probably die than are retrieved from the ponds. Birds landing on the ponds become disabled when crystals form on their feathers. Crystallization usually causes death from drowning, exposure, chilling, and/or shock.

Action Taken:

Since 1973, FWS, Special Agents have documented migratory bird mortality in trona ponds operated by FMC and Stauffer Corporations. Special Agents and the U.S. Attorney have notified representatives of the chemical companies of their liability under the Migratory Bird Treaty Act. Trona plants initiated bird hazing and implemented a bird rehabilitation program in 1975. Bird hazing and rehabilitation have been ineffective at preventing bird mortality.

Recommended Action:

Alternatives need to be developed and implemented to eliminate the toxic components in trona ponds or to eliminate bird use of trona ponds. FWS should determine whether a damage assessment is warranted. Trona wastewater should be disposed into inactive underground mine tunnels to avoid surface disposal ponds and the associated hazard to migratory birds. FWS should address trust resource concerns at future trona mines during the permit process..

Sources of Information

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Appendix

Table 1. Resource Conservation and Recovery Act (RCRA) sites in Wyoming with potential contaminant risks to natural resources.

		Hazardous Substance Release and/or Potential Threat To:				
RCRA SITE	COUNTY	GROUND WATER	SURFACE WATER	OPEN PONDS	SOIL	AIR
AMOCO Oil Refinery	Natrona				X	
AMOCO Pipeline Tank Farm	Natrona	X			X	
Frontier Oil Refinery	Laramie	X	X		X	X
Glacier Park Property	Laramie				X	
Little America Refinery	Natrona	X			X	
Sinclair Oil Refinery	Carbon	X			X	
TEXACO Refinery	Natrona	X			X	
Union Pacific Railroad	Albany	X				
Union Pacific Railroad	Laramie				X	
Wyoming Refinery	Weston		X			
Yellowstone Refinery	Park	X			X	

Table 2. Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites (Non-National Priority List NPL) in Wyoming with potential contaminant risks to natural resources.

		Hazardous Substance Release and/or Potential Threat To:				
CERCLA SITE (Non-NPL)	COUNTY	GROUND WATER	SURFACE WATER	OPEN PONDS	SOIL	AIR
Arlington Wyoming Spill	Carbon	X	X		X	
Baker Bean & Feed Company	Park				X	X
Big Piney Air Compressor Station	Sublette				X	
Buffalo Refinery	Johnson	X				
Camp Guernsey	Platte		X		X	
Chemical Marketing Services	Natrona				X	
Crude Processing - Byron	Big Horn			X	X	
Crude Processing - Frannie	Park	X		X	X	
Ellerby's Refinery	Fremont				X	X
Empire State Oil Refinery	Hot Springs	X	X			
Green River Air Compressor Station	Sweetwater				X	X
Lovell Refinery	Big Horn		X		X	
Mountaineer Refinery	Lincoln	X		X	X	
North Casper PCE Plume	Natrona	X				
Opal Plant	Lincoln				X	
Pacific Steel	Sweetwater		X		X	
Rock Springs Hide & Fur Company	Sweetwater				X	
Smith Site	Goshen		X		X	
Torrington Hide and Metal	Goshen		X		X	
Union Pacific Railroad	Sweetwater				X	
Union Reclamation Dump	Uints			X	X	
VA Medical Center	Sheridan				X	
Worland Solvent Plume	Washakie	X	X		X	X
Yttrium Processing Plant	Albany				X	

Table 2. CERCLA sites (NPL) in Wyoming with potential contaminant risks to natural resources (Con't).

		Hazardous Substance Release and/or Potential Threat To:				
CERCLA SITE (NPL)	COUNTY	GROUND WATER	SURFACE WATER	OPEN PONDS	SOIL	AIR
Baxter/Union Pacific Tie Treatment Facility	Albany	X	X	X	X	
F.E. Warren Air Force Base	Laramie	X	X		X	
Mystery Bridge/Brookhurst Subdivision	Natrona	X			X	X

Table 3. Sites in need of environmental contaminants assessments to determine risks to fish and wildlife resources.

SITE	COUNTY	WATERSHED	CONTAMINANTS	RECOMMENDED ACTION
Jim Bridger Power Plant	Sweetwater	Green	Sodium Decahydrate	Work with LE & Pacific Power to resolve problem
Naughton Power Plant	Lincoln	Green	Sodium Decahydrate	Work with LE & Pacific Power to resolve problem
FMC Coke Processing Facility	Lincoln	Green	Coal Ash, Sludge Wastes	Work with LE & FMC to resolve problem
Ferris-Haggerty Copper Mine	Carbon	Little Snake	Copper	Follow-up on WY DEQ legal action.
Kirwin Mine	Park	Wood River - Big Horn	Copper, Trace Elements	Field Reconnaisance Needed to Assess Problem
Rock Creek	Fremont	Sweetwater - North Platte	Mercury	Coordinate with WGF & DEQ & Follow-up with Field Reconnaisance
Willow Creek	Fremont	Sweetwater - North Platte	Mercury	Coordinate with WGF & DEQ & Follow-up with Field Reconnaisance
Chevron Fertilizer Plant	Sweetwater	Green	Low pH in wastewater pond	Work with LE & Chevron to resolve problem
Horse Creek	Goshen	North Platte	Irrigation Return-Flow	Assess closed basin ponds for Se bioaccumulation
Shoshone Irrigation Project - Wiley Lake	Park	Shoshone	Irrigation Return-Flow	Assess Wiley Lake for Se bioaccumulation
Shoshone Irrigation Project - Beck Lake	Park	Shoshone	Irrigation Return-Flow	Assess Beck Lake for Se bioaccumulation

Table 3. Sites in need of environmental contaminants assessments to determine risks to fish and wildlife resources (Con't).

SITE	COUNTY	WATERSHED	CONTAMINANTS	RECOMMENDED ACTION
Elk-Lovell/Lovell Lakes	Big Horn	Shoshone	Irrigation Return-Flow	Assess Lovell Lakes for Se bioaccumulation
Westside Irrigation	Washakie	Bighorn	Irrigation Return-Flow	Assess closed basins or oxbow ponds for Se bioaccumulation
Frontier Refinery/ Crow Creek	Laramie	South Platte	PAH's	Assess potential for damages to natural resources
Oil Refinerys at Casper	Natrona	North Platte	PAH's	Coordinate with EPA on assessment of PAH's in fish
Wyoming Refinery	Weston	Cheyenne	PAH's	Assess for potential surface water contamination downstream of facility
Yellowstone Refinery	Park	Shoshone	PAH's	Assess potential for damages to Shoshone River ecosystem
Sinclair Refinery	Carbon	North Platte	PAH's	Assess potential for bird mortalities in wastewater pond & damages to North Platte ecosystem
F.E. Warren AFB	Laramie	Crow Creek - South Platte	PAH's	Coordinate with USGS & EPA on assessment of damages to trust resources
Union Pacific Tie Treating Facility	Albany	Laramie	Pentachlorophenol	Coordinate with EPA on assessment of damages to trust resources
Arlington Spill	Carbon	North Platte	Herbicides	Obtain more information & follow-up with assessment of damages if necessary
Camp Guernsey	Platte	North Platte	PAH's, Trace Elements, Pentachlorophenol	Coordinate with EPA & assess potential for contamination of North Platte River

Table 3. Sites in need of environmental contaminants assessments to determine risks to fish and wildlife resources (Con't).

SITE	COUNTY	WATERSHED	CONTAMINANTS	RECOMMENDED ACTION
Crude Processing - Byron	Big Horn	Shoshone	Oil, PAH's	Coordinate with EPA & assess potential for damages to trust resources
Crude Processing - Frannie	Park	Shoshone	Oil, PAH's	Coordinate with EPA & assess potential for damages to trust resources
Empire State Oil Co.	Hot Springs	Bighorn	Oil, PAH's	Coordinate with EPA & assess potential for damages to trust resources
North Casper PCE Plume	Natrona	North Platte	PCE	Coordinate with EPA & assess potential for damages to trust resources
Pacific Steel	Sweetwater	Green	PCB's	Coordinate with EPA & assess potential for damages to trust resources
Torrington Hide & Metal	Goshen	North Platte	Spent Acids, Lead Acid Batteries	Coordinate with EPA & assess potential for damages to trust resources
Union Reclamation Dump	Uinta	Bear	Solvents, Trace Elements	Coordinate with EPA & assess potential for damages to trust resources
Worland Solvent Plume	Washakie	Bighorn	Solvents	Coordinate with EPA & assess potential for damages to trust resources

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